Peanut Yield Response to Conservation Tillage, Winter Cover Crop, Peanut Cultivar, and Fungicide Applications[1]

Ronald B. Sorensen[2]*, Timothy B. Brenneman[3], and Marshall C. Lamb[2]

ABSTRACT

Strip tillage with various crop covers in peanut (*Arachis hypogaea*, L.) production has not shown a clear yield advantage over conventional tillage, but has been found to reduce yield losses from some diseases. This study was conducted to determine pod yield and disease incidence between two tillage practices, five winter cover crops, three peanut cultivars, and three fungicide programs. Conventional and strip tillage treatments were implemented on a Greenville sandy loam (fine, kaolinitic, thermic Rhodic Kandiudults) near Shellman, GA. Five winter cereal grain cover crops (strip tillage) and a no-cover crop treatment were sprayed at recommended (1R), half recommended (0.5R) or untreated (0R) fungicide programs. Within peanut cultivars, leaf spot (*Cercospora arachidicola* Hori) intensity decreased as the number of fungicide applications increased; however, stem rot (*Sclerotium rolfsii*) incidence was the same for the 1R and 0.5R fungicide programs but increased 0R program. Conventional tilled peanuts developed more leaf spot compared with strip tillage. There was no difference in leaf spot ratings among winter crop covers. There was no difference in stem rot incidence with tillage or winter cover crop. There was no yield difference with peanut cultivar. Pod yield was the same for the 1R and 0.5R fungicide program (3867 kg/ha) but decreased at the 0R fungicide program (2740 kg/ha). Pod yield was greater with conventional tillage and strip tillage with black oats (*Avena sativa* L.) (3706 kg/ha) compared with strip tillage of other winter crop cover treatments (3358 kg/ha). Conventional tillage had more leaf spot, equal incidence of stem rot, and higher yield compared with strip tillage. The 0.5R fungicide program had the same yield compared with the 1R fungicide program implying a possible 50% savings on fungicide applications on well rotated fields with lower disease risk.

Key Words: *Arachis hypogaea*, strip tillage, conventional tillage, cover crops.

Strip tillage, a form or conservation tillage that disturbs a small strip of land where the crop is planted (Johnson *et al.*, 2001), can be an effective management tool to reduce peanut production costs. However, the acceptance of strip-tillage has been slow due to grower concerns of increased plant/soil born diseases and ultimately loss of yield. The basis for yield loss is described in early work described by Boyle (1956) who strongly recommended burial of plant debris which could serve as a food source for *Sclerotium rolfsii* (stem rot) if left near the soil surface. In peanut, yield and disease response due to conservation tillage practices are not consistent from study to study because of different peanut cultivars, various cover crops, management procedures, and different disease pressures. In addition, new peanut cultivars have been released with better disease resistance genes than older cultivars.

Winter cover crops, typically cereal grains, are planted for animal production, erosion control, or part of a normal crop management system. In the spring, peanut is planted into the grain stubble using strip tillage equipment. There is no clear answer as to which is better, conventional or strip tillage, as yield results have been mixed depending on the year and selected management techniques (Grichar, 1998; Johnson *et al.*, 2001; Prostko, 2001). However, strip tillage has been shown to reduce plant disease, especially tomato spotted wilt (TSW) caused by T*omato Spotted Wilt Virus* (Harris, 2002: Cantonwine *et al.*, 2006) and leaf spot caused by *Cercosporidium personatum* (Berk. & M.A. Curtis) Deighton (Monfort *et al.*, 2004). Various researchers have shown disease reductions or no effect on stem rot, Rhizoctonia limb rot (*Rhizoctonia solani* Kühn), and TSW (Minton *et al.*, 1991; Grichar, 1998; Johnson *et al.*, 2001; Monfort *et al.*, 2004) with strip tillage and associated cover crops. Controlling disease with up to seven fungicide applications in one year can be quite costly to the grower at approximately 20% of the total variable costs. Reducing fungicide applications without loss of yield would be beneficial to the grower by reducing time, labor, and fungicide product applied to the field. Monfort *et al.* (2004) showed that the

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[2]R.B. Sorensen, Res. Agronomist, and M.C. Lamb, Supervisory Res. Food Technologist, USDA-ARS-Natl. Peanut Res. Lab., PO Box 509, 1011 Forrester Dr. SE, Dawson, GA 39842.

[3]T.B. Brenneman, Prof., Dep. of Plant Pathology, Univ. of Georgia Coastal Plain Exp. Stn., P.O. Box 748, Tifton GA.

*Corresponding author: (ron.sorensen@ars.usda.gov).

same leaf spot intensity could be achieved with strip tillage and with decreased number of fungicide applications compared with conventional tillage and a full regimen of applied fungicides. In addition, they showed that suppression of leaf spot did not always relate to higher pod yield. Cantonwine *et al.* (2006) had comparable returns with programs requiring 4, 5 or 7 fungicide applications with highest returns on cultivars C-11-2-39, C-99R (Gorbet and Shokes, 2002a), and Georgia-01R (Branch, 2002). Cultivar Georgia Green (Branch, 1996) with conventional tillage and a full fungicide regimen (7 applications) had lower returns compared with other tillage and cultivar systems. Both Cantonwine *et al.* (2006) and Monfort *et al.* (2004) agreed that strip tillage along with resistant cultivars reduce leaf spot and were comparable with conventional tillage and full spray regimen.

The use of strip tillage in a peanut/cotton rotation irrigated with subsurface drip irrigation (SDI) could be of major interest in conserving water, reducing agronomic inputs, and possibly increasing on-farm revenue. Subsurface drip irrigation on peanut in the humid southeast has been effective in increasing pod yield and grade specifically kernel size distribution (Sorensen *et al.*, 2000a) when compared with nonirrigated peanut production (Lamb *et al.*, 1997). Phene *et al.* (1992) suggested that SDI can contribute to maximizing water use efficiency with negligible soil evaporation, percolation, and runoff. Expanding SDI to other agronomic crops and rotations would benefit the agricultural community in areas of water management, crop rotation, conservation tillage, yield potential, and economic viability of such systems.

The objectives of this research were to determine the effects of winter cover crop, peanut cultivar, and fungicide program on peanut diseases, pod yield, grade, and kernel size distribution when irrigated with subsurface drip irrigation.

Material and Methods

This two-year project was conducted at Shellman, GA and is associated with the Shellman Multi-Crop Irrigation Research Farm. The soil is classified as a Greenville sandy loam (fine, kaolinitic, thermic Rhodic Kandiudults). The experimental design was a split-split plot. Whole plots were arranged in a randomized complete block design with three replicates fungicide treatments applied perpendicular to whole plots. Fungicide programs were fully recommended (1R), half of recommended (0.5R), and none (0R). Fungicide rate and application schedule for the 1R plots consisted of seven fungicide spray applications following manufacturers' rate and timing recommendations. The 1R fungicide treatment is similar to local extension recommendations which is typically three applications of 1.26 kg ai/ha per application of chlorothalonil (Bravo Ultrex, Syngenta Crop Protection, Greensboro, NC) and four applications of 0.23 kg ai/ha tebuconazole (Folicur3.6F, Bayer Crop Protection, Kansas City, MO). The 0.5R had two chlorothalonil and two tebuconazole matching alternate applications timings of the 1R regimen. Six tillage treatments including no cover (conventional tillage) and strip tillage of soft red winter wheat (*Triticum aestivum*, AGS2000), rye (*Secale cereale*, Abruzzi), two oat (*Avena sativa*) cultivars (Horizon 474, and Soil Saver/Black Oats), and triticale (Triticale 314) were applied to sub-plots. Three peanut cultivars (Georgia Green [GG], DP-1 [DP1: Gorbet and Tilman, 2008], and Georgia-01R [GA01R]) were planted in sub-sub-plots within each crop cover treatment.

Individual sub-sub-plots were 1.8-m wide by 15-m long. The SDI system was installed with drip tube laterals spaced at 0.91-m underneath each crop row and buried at 0.3-m deep. The drip tubing was 0.38-mm thick (15 mil) with emitters spaced at 45-cm, and a flow rate of 1.5 LPH/emitter. An on-site weather station collected meteorological data and estimated potential evapotranspiration (ET_o) using a modified Jensen-Haise equation corrected for local conditions. Irrigations were scheduled daily with water being replaced following water use curves and/or crop coefficients described by Harrison and Tyson (1993). Estimated ET_o was multiplied by the crop coefficient (K_c) and rainfall was subtracted, if any, to estimate the actual plant evapotranspiration (ET_a).

Peanut was planted following a cotton-corn rotation on 8 May 2003 and 07 May 2004. A light tillage operation using a bed-shaper was used to reshape the beds following the mowing of the cotton stalks. Cover crops were planted in the late fall at recommended rates using a grain drill (Black oats, 79 kg/ha; Horizon oats, 147 kg/ha; wheat, 158 kg/ha; rye, 136 kg/ha; and triticale, 124 kg/ha). In early spring (March) the cover crop was sprayed with a post emergence herbicide (glyphosate: *N*-(phosphonomethyl)glycine) to kill existing cereal crop plants and weeds. The conventional tillage plots were prepared using an experimental disk-bedder (USDA-ARS-National Peanut Research Laboratory). The experimental bedder was used once in the fall and twice in the spring prior to planting. A strip tillage unit (without a deep rip shank) was used to prepare a 35 to 45 cm wide seed bed in the cover crop treatments. Peanut seed were planted at 20 seed/m as recommended by the TSW index (Harris, 2002). Soil temperature and soil moisture data were collected during the growing season. Thermocouples (TC) were installed at 5-cm soil depth to collect soil temperature. Sensors were placed within the crop row after planting. Soil temperature data collected were average hourly and daily maximum and minimum soil temperature. Soil moisture was monitored using soil water reflectometers manufactured by Campbell Scientific, Inc. (CS616: Campbell Scientific, Inc. Logan, UT). Soil water content sensors were installed at the same time as the soil temperature probes. Chemical weed control during the growing season, both application and timing, was the same for all tillage treatments.

Disease ratings were taken just prior to digging for early and late leaf spot using the Florida 1–10 scale (Chiteka, 1998) and just after digging for stem rot by counting the number of 30 cm long row segments with symptomatic plants (Rodriguez-Kabana *et al.*, 1975). Within the GG cultivar, 15 individual leaves collected at random from the upper canopy were visually analyzed in each spray treatment for early versus late leaf spot. The GG cultivar was dug 10 September 2003 and 22 September 2004. Cultivars DP1 and GA01R were dug about 20 days later depending on maturity and weather conditions. Peanuts were combined 3 to 5 days after digging depending on drying conditions.

A two row combine with a bagging attachment was used to collect yield data. Total pod mass was determined following accepted drying procedures. Peanut yield and grade were determined following official federal/state inspection guidelines (USDA, 1993).

Data for leaf spot, stem rot, yield and grade parameters were subjected to split-split-plot analysis of variance procedures (Statistix 8, 2003) by year, tillage/cover crop, fungicide, and cultivar as treatments. Data from the above components were pooled across years when ANOVA showed no significance of the year-by-treatment interactions at $P \leq 0.05$. Least significant difference (LSD) was used to separate means when *ANOVA F*-test showed significance.

Results and Discussion

Total precipitation measured during the growing season was similar in both crop years, 648 mm in 2003 and 673 mm in 2004. Precipitation patterns were similar for both years until about day 170. At that point the patterns diverged with precipitation in 2003 being higher during the later part of the growing season compared with 2004 (Fig. 1). Conversely, irrigation patterns were such that the later part of the growing season of 2004 required more irrigation than in 2003. Total irrigation applied was 180 and 262 mm for 2003 and 2004, respectively (Fig. 1).

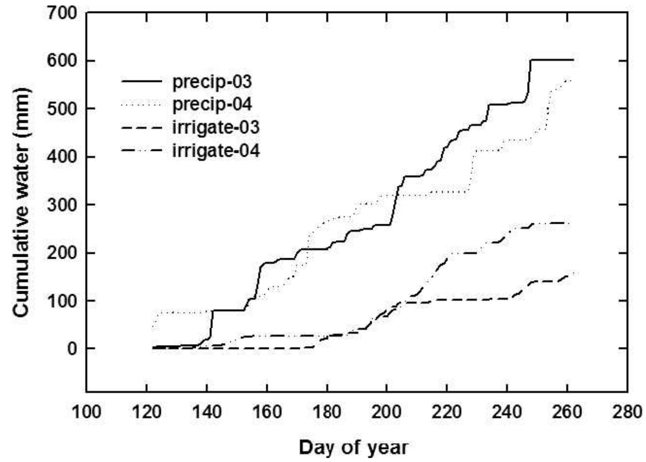

Fig. 1. Cumulative precipitation and irrigation measured during the 2003 and 2004 growing season. Precipitation measured 01 May to 01 October.

Air temperature data indicate that the 2003 growing season was slightly cooler than that of 2004 (Fig. 2). The average maximum air temperature during peanut pegging and pod filling (calendar day 160 to 220) was about 32 C during 2003 and 34 C in 2004. Maximum average soil temperature during this same time period was 26 C during 2003 and 29 C during 2004. The warmer temperatures during the 2004 growing season could account for the extra 80 mm of irrigation water applied compared with the 2003 growing season. These soil temperature data show that once crop cover has been established, soil temperatures were maintained below 29 C and above 21 C as described by Davidson *et al.* (1991) for best pod yield and quality. These soil temperature data coincide with work done by Sorensen and Wright (2002) which showed that SDI systems can maintain soil temperatures at prescribed values.

Soil moisture was also monitored during the growing season. Hourly water content values fluctuated between 0.3 and 0.4 $m^3\ m^{-3}$ volumetric water content depending on precipitation and irrigation events. The average soil water content was 0.29 $m^3\ m^{-3}$ during 2003 and 0.32 $m^3\ m^{-3}$ during 2004 (hourly data not shown).

Precipitation, soil temperature, and irrigation data indicate distinct differences between years that can affect crop yield, grade and disease incidence (Table 1). There were differences by year for all yield parameters tested. Year by tillage (Y*C), year-by-fungicide-treatment (Y*S) and

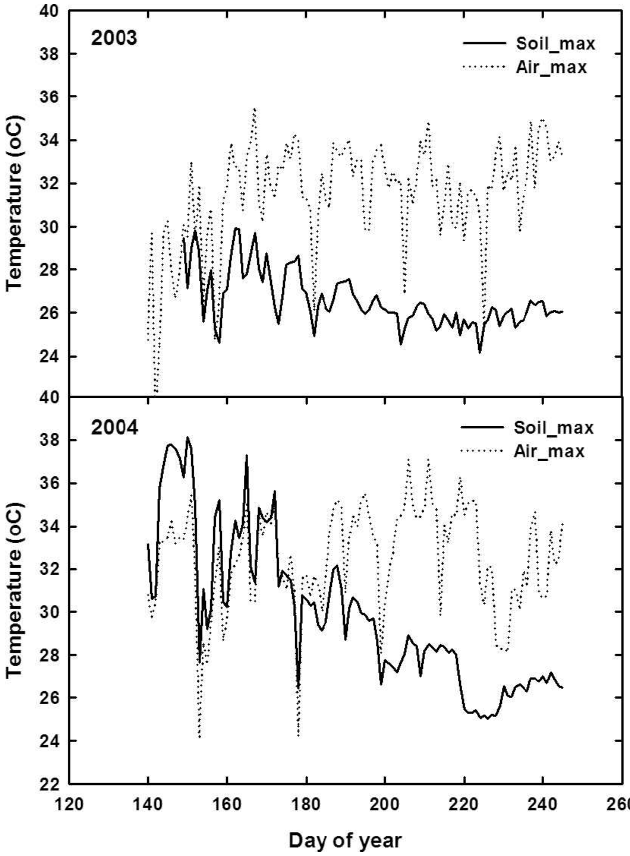

Fig. 2. Maximum daily soil and air temperatures measured during the 2003 and 2004 growing season. Soil temperature measured in the pod zone at about 2.5 cm soil depth.

year-by-peanut-cultivar (Y*P) interactions were detected for yield, disease, or grade parameters. These year-by-treatment interactions imply that each cropping season is different even when total precipitation, irrigation, and temperature values are similar from year to year.

Foliar Disease: In 2003 (data not shown), there was more leaf spot under conventional tillage compared with the strip tilled areas (6.7 vs. 6.4 defoliation rating, P=0.048). Among cultivars, GG had the least leaf spot (5.7 rating) followed by DP1 (6.6 rating) and then GA01R (7.2 rating) ($P < 0.000$). In 2004, there was again more leaf spot under conventional tillage compared with the strip tilled areas (5.5 vs. 5.1 defoliation rating, P=0.007). Among cultivars, GA01R and DP1 had the least leaf spot (5.3 rating) followed by GG (5.4 rating), just opposite from the previous year. Across years there were higher leaf spot ratings under conventional tillage compared with any strip till cover crop (6.1 vs. 5.8 defoliation rating, $P < 0.000$).

Overall, there was more leaf spot in 2003 compared with 2004 (Table 2). As expected, foliar disease ratings for leaf spot were highest in the 0R spray followed by the 0.5R, with the least leaf spot in the 1.0R spray applications (Table 2). Conventional tillage systems had higher leaf spot ratings compared with the grain cover crop treatments (Figure 3). There were no differences among winter cover types within strip-tilled treatments (Figure 3). These results support the previous findings of Cantonwine *et al.* (2006) and Monfort *et al.* (2004) of higher leaf spot ratings in conventional tillage compared with strip tillage.

Peanut cultivar affected leaf spot ratings with the lowest disease ratings in GG (5.6 rating) followed by DP1 (5.8 rating) and then GA01R (6.1 rating). The crop-cover-by-cultivar interaction showed that cultivar had more of an effect on disease than crop cover such that GG had lower ratings of leaf spot followed by DP1 then GA01R. Fungicide spray application programs affected leaf

Table 1. Analysis of variance probability values for pod yield, foliar disease, soil-born disease, total sound mature kernels (TSMK), other kernels, and kernel size distribution (jumbo, medium, and No. 1).

		Probability values							
Source	df	Yield	Foliar disease	Soilborne disease	TSMK	Other kernels	Jumbo kernels	Medium kernels	No. 1 kernels
Year (Y)	1	0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Cover (C)	5	0.012	0.000	0.902	0.028	0.041	0.467	0.576	0.468
Spray (S)	2	0.000	0.000	0.000	0.021	0.000	0.038	0.010	0.033
Peanut (P)	2	0.234	0.000	0.000	0.003	0.000	0.000	0.000	0.000
YxC	5	0.000	0.534	0.429	0.093	0.012	0.578	0.514	0.326
YxS	2	0.876	0.000	0.000	0.512	0.462	0.254	0.233	0.812
YxP	5	0.582	0.000	0.001	0.000	0.000	0.000	0.000	0.119
CxS	2	0.976	0.598	0.986	0.968	0.893	0.997	0.831	0.972
CxP	10	0.050	0.034	0.266	0.335	0.019	0.000	0.000	0.003
SxP	10	0.071	0.000	0.523	0.203	0.039	0.239	0.452	0.023
YxCxS	4	0.974	0.665	0.987	0.970	0.716	0.956	0.943	0.947
CxSxP	10	0.829	0.548	0.999	0.978	0.986	0.999	0.999	0.998
YxCxSxP	20	0.992	0.000	0.999	0.759	0.607	0.075	0.021	0.237

Table 2. The average treatment effects of year, fungicide program, and peanut cultivar on pod yield, leaf spot, stem rot, total sound mature kernels (TSMK), and other kernels.

Treatment	Yield	Leaf spot Rating	Stem Rot	TSMK	Other kernels
	kg/ha	*1=none to 9=complete*	*%*	*%*	*%*
Year					
2003	3617a	6.5b	5.9b	75.6a	2.6b
2004	3352b	5.2a	12.8a	67.7b	5.1a
Fungicide program					
1.0R	3845a	3.9c	6.0c	71.0b	4.3a
0.5R	3868a	5.7b	8.0b	71.6ab	3.7b
0R	2740b	7.9a	14.0a	72.4a	3.6b
Cultivar					
GG	3575a	5.5c	7.3b	71.2b	4.7a
DP1	3444a	5.8b	8.5b	71.0b	3.9b
GA01R	3434a	6.1a	12.3a	72.8a	2.9c

Values in each column and within each treatment with the same letter are not significantly different.

spot. Within the 1R and the 0.5R fungicide application program GG had the lowest leaf spot ratings followed by DP1 and then GA01R. At the 0R fungicide application treatment, DP1 had the lowest leaf spot rating followed by GA01R, then GG (Table 1 and Table 4). There was also a highly significant year-by-spray (Y*S), year-by-cultivar (Y*P), and cultivar-by-spray (C*S) interaction for leaf spot rating (Table 1, 2 and Table 3).

Monfort *et al.* (2004) showed that leaf spot severity decreased in a full fungicide program and that strip-tillage also tended to suppress leaf spot. They also showed that leaf spot-resistant cultivars, Florida MDR98 (Gorbet and Shokes, 2002b) and C-99R had lower disease ratings compared with GG. Overall, Monfort *et al.* (2004) concluded that fungicide applications could be reduced with out compromising leaf spot control, especially when using strip tillage and resistant cultivars. Cantonwine *et al.* (2006) showed that DP1 and GA01R had good resistance to leaf spot followed by GG which is opposite in order compared to data shown above. This could be explained by our harvest dates. The cultivar GG was harvested about 20 days earlier than either DP1 or GA01R according to the maturity profiles. In this research, if GG had not been harvested when mature, but waited to be harvested with the other cultivars (DP1 and GA01R), it would seem plausible that leaf spot would have increased and resultant disease ratings would be similar to those described by Cantonwine *et al.* (2006).

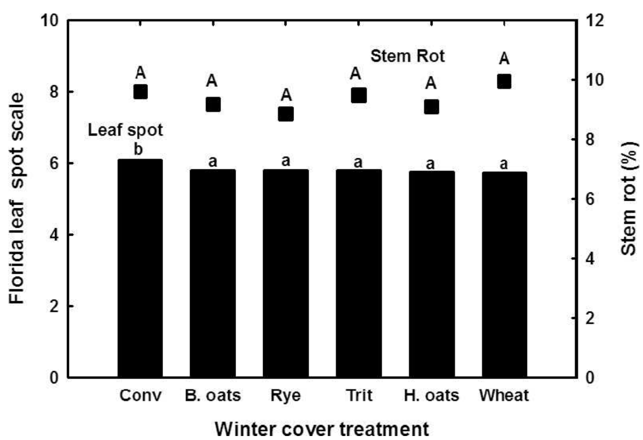

Fig. 3. Peanut leaf spot ratings and percent stem rot infection by winter cover crop for the 2003 and 2004 growing season. Letters (upper and lower case) indicate difference between the mean values at the P ≤ 0.05 level.

Individual leaf analysis for the GG cultivar showed differences between years and between early leaf spot and late leaf spot. In 2003, the percent early leaf spot was 43%, 73%, and 100% for 1.0R, 0.5R and 0R fungicide program, respectively. In 2004, the percent early leaf spot was 100%, 94%, and 88% for 1.0R, 0.5R and 0R fungicide program, respectively (data not shown).

Soil borne disease: There was less stem rot in 2003 compared with 2004 (Table 2). Stem rot incidence decreased as fungicide applications increased, ranging from 6% (1R) to over 14% (0R). Both GG and DP1 had about the same stem rot incidence with an average 7.9% while GA01R had 12.3% incidence. Table 3 shows the interaction of cultivar (P: peanut) by fungicide (S: spray) application (P*S) indicating that GG and DP1 tend to have less stem rot than GA01R in any of the fungicide programs used. Type of cover crop (strip tillage) or no cover crop (conventional tillage) had no effect on stem rot incidence (Fig. 3). Fungicide application had more effect on stem rot incidence than crop cover type or tillage regime. These findings are similar to those describe by Johnson

Table 3. Response of peanut yield, total sound mature kernels (TSMK), leaf spot and stem rot to three fungicide treatments.

Fungicide program	Pod yield	TSMK	Leaf Spot	Stem Rot
	kg/ha	%		
		Georgia Green		
1R	4078a	71.2bc	3.3g	3.9e
0.5R	4009a	71.2bc	5.2e	5.1e
0R	2637c	71.1bc	8.2a	12.8b
		DP-1		
1R	3677b	70.4c	4.1f	5.1e
0.5R	3780ab	70.7c	5.9d	7.8d
0R	2876c	71.9bc	7.5c	12.b
		Georgia-01R		
1R	3780ab	71.1bc	4.2f	9.0cd
0.5R	3816ab	73.0ab	6.1d	11.1bc
0R	2707c	74.2a	8.0b	16.7a

Values in each column with the same letter are not significantly different.

et al. (2001) which showed no difference in stem rot incidence between conventional and strip tillage.

Pod yield and grade: In 2003, there was no yield response to cover crop (strip tillage) or conventional tillage (Fig. 4). There was no difference in yield between peanut cultivars. Pod yield increased as fungicide applications increased. Pod yield was the same for the 1R and 0.5R fungicide application regimen at 4002 kg/ha and decreased to 2848 kg/ha at the 0R application (data not shown).

In 2004, the conventional tillage and black oats cover crop had the higher yields (3830 kg/ha) compared with the other cover crops (3113 kg/ha) (Fig. 4). There was no difference in pod yield between cultivars. Similar to 2003, pod yield tended to increase as fungicide applications increased. Pod yield for the 1R and 0.5R fungicide programs was the same (averaged 3711 kg/ha) and greater than the 0R treatment (2632 kg/ha) (data not shown).

Overall pod yield was higher in 2003 than in 2004 (Table 2).There was a yield difference with fungicide applications in that 1R and 0.5R had the same yield (average 3856 kg/ha) and was over 1000 kg/ha higher than yield at the 0R treatment. Percentages of total sound mature kernels (TSMK) were different with winter crop cover types with only 3 percentage points between the highest and the lowest values (73% conventional tillage versus 70% for triticale, P = 0.028; data not shown). Kernel size distribution (jumbos, mediums, and ones) show significant effects of fungicide program and cultivar but not winter cover crop (Table 1). The fungicide program by cultivar (S*P; Table 1) interaction shows that cultivar had more effect on kernel size than the fungicide program (data not shown). This can be explained by distinct varietal differences between the three cultivars. Both DP1 and GA01R are later in maturity and larger seeds compared with GG. Therefore, it stands to reason that no matter the yield, fungicide program, or winter cover type, the kernel size distribution comparisons will always show the large seeded peanut with statistically more jumbos.

Peanut growers will apply four or more fungicide treatments per year with many using seven or more applications per year. There is clear evidence showing that fungicide treatments are needed to manage both leaf spot and stem rot. The question is

Table 4. Farming practices and estimated costs used for conventional and strip tillage operations for peanut during the 2003 and 2004 growing season. Fungicide and total costs are for 0R, 0.5R and 1R treatments (0, 4 and 7 fungicide applications). These values do not represent a full economic budget but represent the differences between the two tillage systems.

Conventional Tillage	Estimated Cost $/ha			Strip Tillage	Estimated Cost $/ha		
Disk harrow	18.90			†Bed shape	6.38		
†Bed shape (3)	19.15			‡Plant cereals	10.33		
Herbicide	13.17			Spray cereals	32.76		
Incorporate	7.60			†Strip till	7.88		
Fungicide (0/4/7)	0.00	114.01	203.73	Fungicide	0.00	114.01	203.73
Total cost (0/4/7)	59.82	173.83	263.56		57.37	171.38	261.10

†Experimental equipment and costs are estimates from similar equipment.
‡Cost for the equipment only and not for individual cereal crop planted.

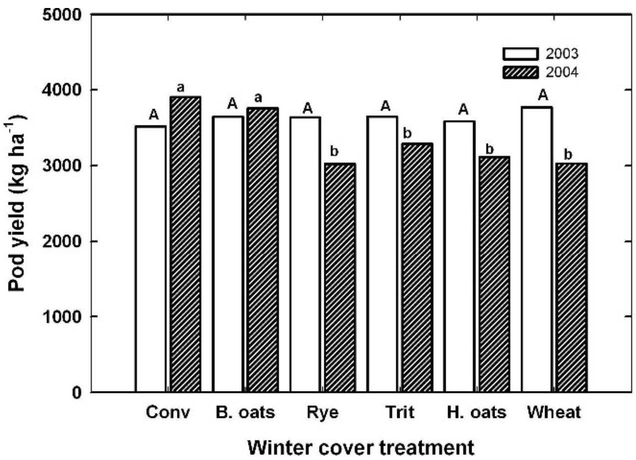

Fig. 4. Peanut pod yields by winter cover crop measured during the 2003 and 2004 (upper and lowercase letters, respectively) growing season. Letters, upper (2003) and lower (2004) case, indicate difference between the mean value at the P ≤ 0.05 level.

whether or not growers can rely on fewer fungicide applications to control disease for economic returns. When the 0R fungicide application treatment was removed from the analysis, there was no difference in yield between the 1R and 0.5R fungicide application treatments or among types of cover crop. Yield differences were noted by year (P=0.0015) and by cultivar (P=0.0116). Climatic differences between years can explain some of the yield variability implying that temperature and precipitation affect peanut yield.

Economics. Conventional tillage requires different farming operations than does strip tillage (Table 4). Equipment costs for farm practices are estimates especially for experimental equipment where actual costs are not known (Univ. of Georgia, Agric. and Applied Econ.: www.ces.uga.edu/Agriculture/agecon/budgets/budgetsexcel.htm). The estimated cost of the conventional tillage treatment was $2.45/ha more than the strip tillage treatment. Fungicide treatment cost was proportional to the number of fungicide applications in the treatment, reflecting the cost of fungicide and the equipment cost associated with application. Overall, the cost difference between the two tillage techniques was minimal compared with the variation in cost among the 0R, 0.5R, and 1R fungicide applications. It costs the grower just over $0.02/kg peanuts for tillage operations, compared with $0.045 and $0.07/kg peanuts for the 0.5R and 1R treatment, respectively. It costs 2.25 and 3.5 times more to apply fungicides at 0.5R and 1R, respectively, compared with not applying any fungicides at all. Crop yields for the 0.5R fungicide program were the same as the 1R indicating that it cost the grower to apply the 1R fungicide treatment without any yield benefit, thereby reducing the grower's net returns.

The 0.5R fungicide program had the same yield compared with the 1R program even with increased incidence of foliar and soil-borne disease. These yield and disease data imply that a grower could reduce fungicide applications by half without reducing yield even with increased disease pressure. Growers could save on average about $90/ha on fungicide applications with the 0.5R fungicide program compared with the 1R program. The dollar savings from reduced fungicide applications would be the same for both tillage regimens.

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